Morphology and Electrochemical Properties of Novel Proton Exchange Membranes Containing Fluorine Block Copolymers

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For the purpose of investigating whether an ionic clustered morphology is necessary for good proton conduction and whether the incompatibility of polymer blocks will facilitate aggregation of ions in fuel cell membranes, a series of well-defined sulfonated fluorine block copolymers have been synthesized.

The chain length of the blocks can be adjusted so that the ion exchange capacity (IEC) can be controlled. The conductivity of these membrane films cast from solutions has been determined by impedance spectroscopy and is in the same order of magnitude as Nafion®. The dependence of conductivity on the ion exchange capacity and water uptake has been studied.

Evidence for microphase separation of fluorinated block copolymers was found by transmission electron microscopy (TEM) shown in Figure 1. The relationship between conductivity and microphase separation of these membranes will be discussed.

The electrochemical properties for oxygen reduction of these proton exchange membranes are evaluated in half fuel cell operation. The role of polymer morphology on properties pertinent to fuel cell operation will be presented.

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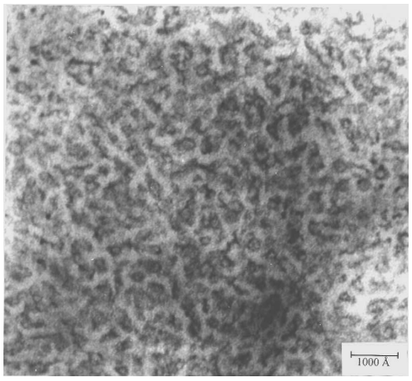

Figure 1. TEM image of a fluorinated block copolymer membrane with IEC 0.7 mol/g.